Alternative Technologies and the Road to Zero Waste to Landfill

For the Maryland Recyclers Network
Annual Conference
The Maritime Institute, Linthicum, MD

Harvey W. Gershman
President
Gershman, Brickner & Bratton, Inc.

June 20, 2014

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- Solid Waste Management and Technology Consultants established in 1980
- Helping Clients Turn Problems into Opportunities
  - Proud to be a sustaining sponsor of MRN
  - www.gbbinc.com

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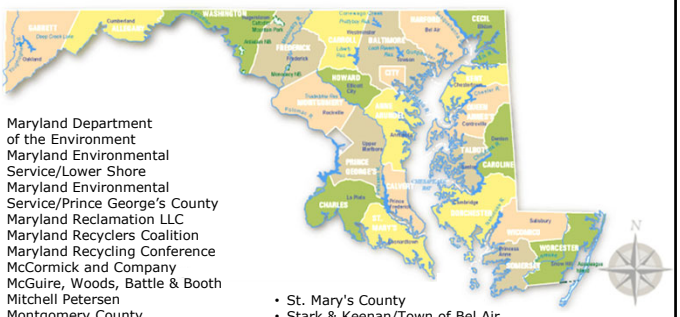
- Attorney General's Office
- City of Baltimore
- Baltimore County
- Calvert County
- Calvert Trash Service, Inc.
- Caroline County
- Charles County
- Clean Rock Industries
- Columbia County
- CSI Norfolk
- Easton Utilities Commission
- F&E Stokers
- Fort Meade
- Frederick County
- Gaithersburg
- Gatlinburg
- Geosyntec
- Harford County
- Howard County
- Johns Hopkins Medical Center
- Legg Mason Wood Walker, Inc.
- Leimbach Development
- Waste News
- Marriott Corporation



- Maryland Department of the Environment
- Maryland Environmental Service/Lower Shore
- Maryland Environmental Service/Prince George's County
- Maryland Reclamation LLC
- Maryland Recyclers Coalition
- Maryland Recycling Conference
- McCormick and Company
- McGuire, Woods, Battle & Booth
- Mitchell Petersen
- Montgomery County
- Northeast Maryland Waste Disposal Authority (NMWDA)
- Ocean City
- Office Paper Systems , Inc.
- OREG Site Work Services, LLC
- Prince George's County
- Queen Anne's County
- Recycling Inc.
- Reese & Carney, LLP
- Rogers Golden Halprin / NMWDA
- Somerset County

- St. Mary's County
- Stark & Keenan/Town of Bel Air
- State of Maryland
- SWANA
- SWANA (as GRCDA)
- Talbot County
- The Recycling Center
- Town of Easton
- URS/Maryland Environmental Service
- US Postal Service-Baltimore Division
- University of Maryland
- Washington County
- Wicomico County

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Renewable Energy from Waste

RENEWABLE Energy FROM WASTE CONFERENCE

NOVEMBER 17-20, 2014 SAN JOSE, CALIFORNIA

Food Waste or Fuel Source?

DEPARTMENTS - CRITICAL THINKING

Harvey Gershman
OCTOBER 16, 2013

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www.rewmag.com

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Hahvee…take out the gahbidge…it stinks!" my mom used to remind me of my household chore growing up in Pawtucket, R.I., in the '60s. We had a 30-gallon can for food waste in the back corner of our lot waiting to be collected by the city and delivered to pig farmers for feed. Neighboring Providence did it a little differently. It had to be bundled in newspapers and set out for collection, eventually to find its way to pig farmers.

Fast-forward to the new millennium. We are serious about increasing recycling even more by going after organics. The U.S. Environmental Protection Agency reports that food waste accounts for approximately 21 percent of landfilled municipal solid waste (MSW), or around 35 million tons per year (TPY). This waste is a resource that can be used to produce biogas, for power production or

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Today's Agenda
U.S. Overview
• Disposition and Costs
• Collection Choices
Worldwide Experience
• What other countries have achieved and why
Technologies
• What are they, their status, and availability?
Maryland and the Draft Zero Waste Plan
• Where is Maryland starting from
• Challenges and examples elsewhere
Maryland Needs a Green Gate
• Exporting is not sustainable
• Domestic markets pull needed
Moving Forward in Maryland
• Appropriate Targets for Disposition
• Green Gate Policies
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U.S. Overview
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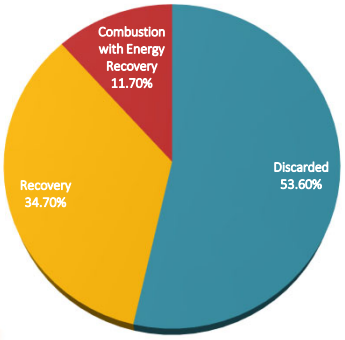
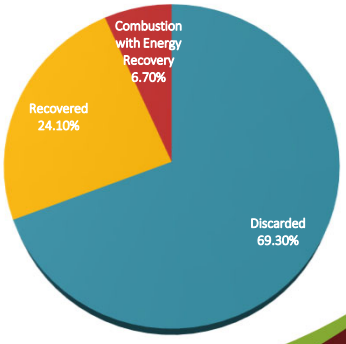
Disposition of MSW in the U.S.

EPA Estimate:
250 million tons (2011)



Biocycle Estimate:
389 million tons (2008)



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U.S. Waste Management Infrastructure

Technology	Operating Plants
Source Separation Collections	########
Material Recovery Facilities (MRF)	586
Composting	2,300
Mixed Waste Processing Facilities (MWPF)	51
Mass Burn WTE	65
Modular WTE	9
RDF -Processing &/ or Combustion	20
Anaerobic Digestion	19
Transfer Stations	No data
Landfills	1,908

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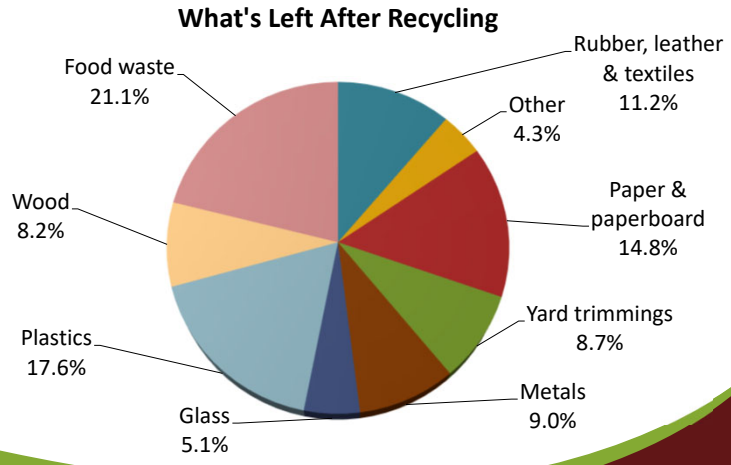
MSW Going to Landfill – EPA 2012



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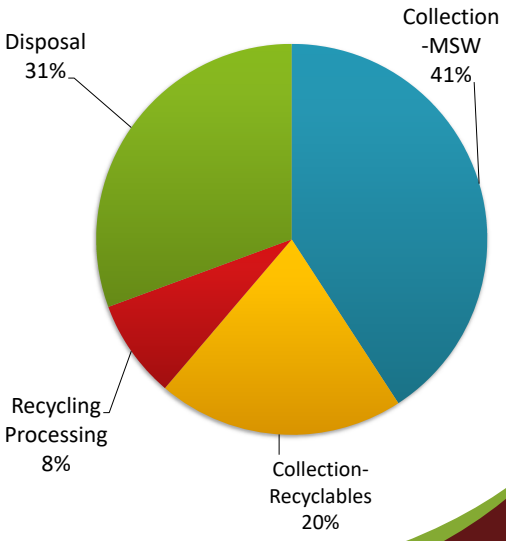
Net Cost of Collection and Disposal

- Everything = $100 to $500 per ton
- WTE = $68 per ton (2010)
- Landfill = $45 per ton (2012)



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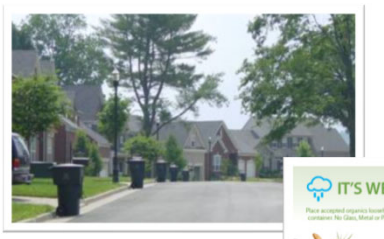
Collection Needs to Match Up with Technologies

One bin – two bin – three bin – four?

Which shall it be to be greener evermore?



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Residential Food Waste Collection Growing - 2.2 % in 2013

183 communities offer curbside collection of residential food waste

18 states	2.55 million households	726,250 tons in 2012*

Source: BioCycle Magazine, March 2013

* 79% of programs reporting

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What can reduce the 60% of America's Waste that's currently going to Landfills?

- More source separated single-stream recycling
- Food waste/ expanded organics collections
- Conversion technologies for liquid fuels and chemicals – if they work!
- Mixed waste processing for recyclables and fuel/feedstocks
- Proven WTE; but depends on:
  - Energy economics
  - Political will
- All together called "MBT"

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Worldwide Experience

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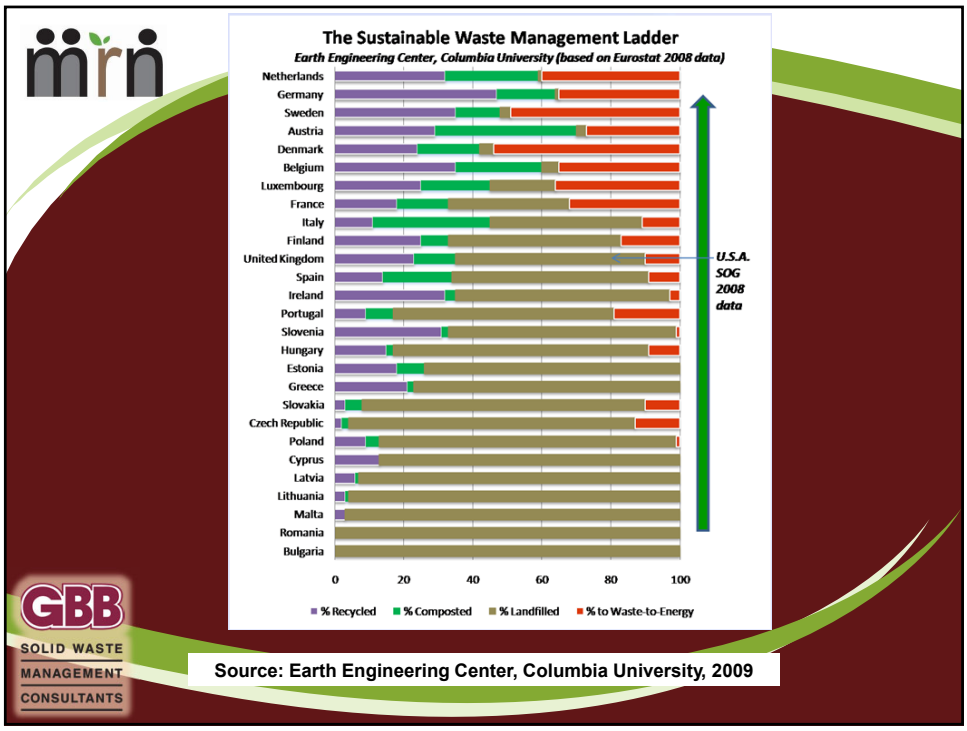

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How High are the EU Landfill Taxes?

- Highest landfill tax rates and a ban too!
  - More than $100 per ton!!
- 1999 EU Landfill Directive
  - Reduce biodegradable waste sent to landfill 65% by 2020
- EU targets to be met by 2020 (the '20-20-20' targets):
  - Greenhouse gas emissions of at least 20 percent below 1990 levels
  - 20 percent of energy consumption from renewables
  - 20 percent reduction in primary energy use by energy efficiency

Country	Landfill Tax
Austria	€ 87
Belgium	€60-€80
Denmark	€ 63
Finland	€ 40
France	€ 70
Germany	Ban
Ireland	€ 50
Netherlands	€ 107
Norway	€ 59
Sweden	€ 43
UK	€ 63

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Increased Interest Worldwide in Renewable EfW Technologies

476 Technology/Project Development Companies

- 28 Aerobic Composting
- 106 Anaerobic Digestion
- 30 Ethanol Fermentation
- 117 Gasification
- 30 Plasma Gasification
- 31 Pyrolysis
- 63 WTE: mass burn, modular, dedicated boilers, and RDF
- 69 Others (e.g., thermal cracking, hydrolysis, steam reforming, agglomeration, de-polymerization)

157 Commercial or Demonstration Facilities

- 70 Anaerobic Digestion
- 57 Gasification
- 10 Plasma Gasification
- 12 Pyrolysis

Source: Gershman, Brickner & Bratton, Inc., June 2014

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Energy/Fuel Product Values Are Key

Converting MSW to…	Product	1 ton MSW yields	Value Per Production Unit	Revenue Per Ton
	Power	500-600 kWh	@ $0.06 / kWh	$30-$36
	Synthetic Crude	4 barrels	@ $80 / barrel	$320.00
	Ethanol	80 gallons	@ $2.50 / gallon	$200.00

++ sale of chemical feedstocks, heat and/or recovered metals

System Capital Costs and O&M Costs impact the NET MSW costs!

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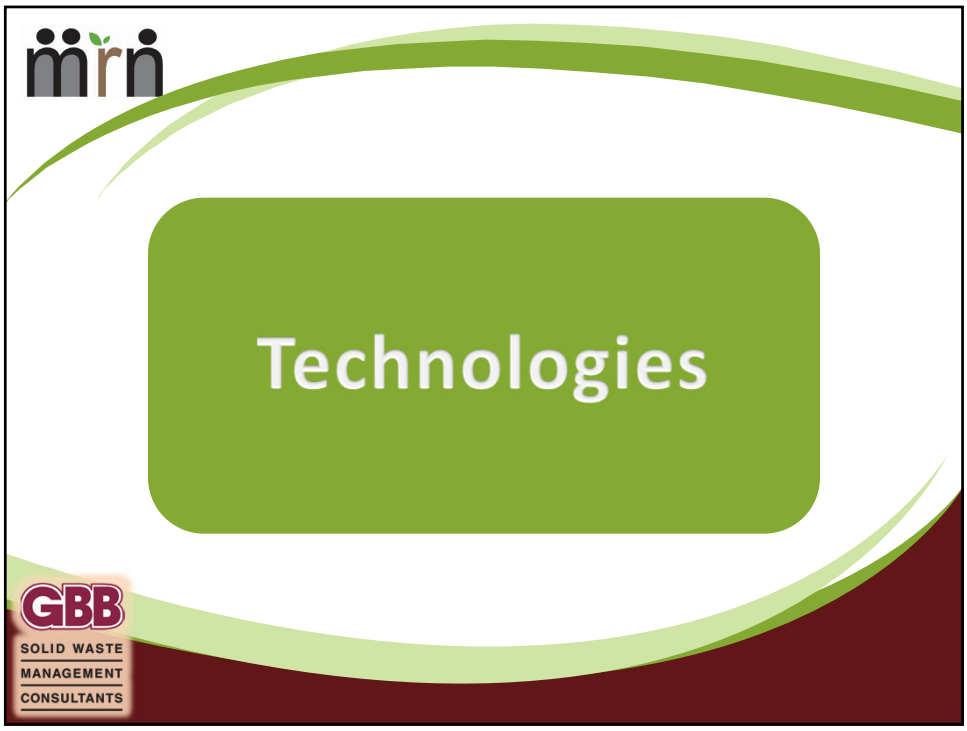
Technologies
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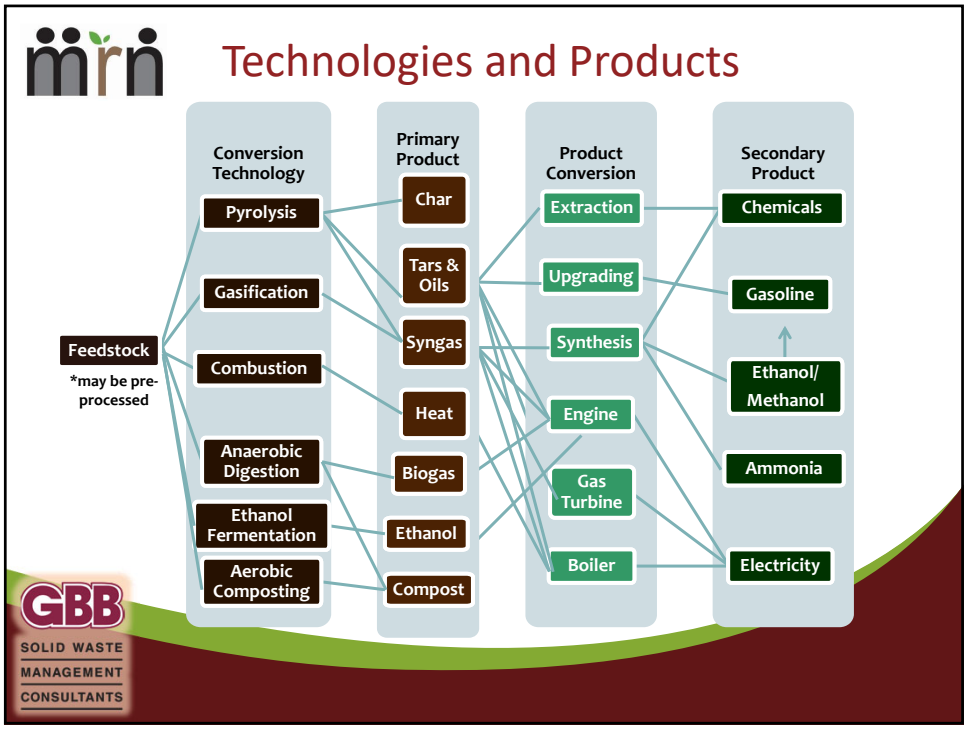
Technologies and Products
Conversion Technology
Primary Product
Product Conversion
Secondary Product
Feedstock
*may be pre-processed
Pyrolysis
Gasification
Combustion
Anaerobic Digestion
Ethanol Fermentation
Aerobic Composting
Char
Tars & Oils
Syngas
Heat
Biogas
Ethanol
Compost
Extraction
Upgrading
Synthesis
Engine
Gas Turbine
Boiler
Chemicals
Gasoline
Ethanol/ Methanol
Ammonia
Electricity
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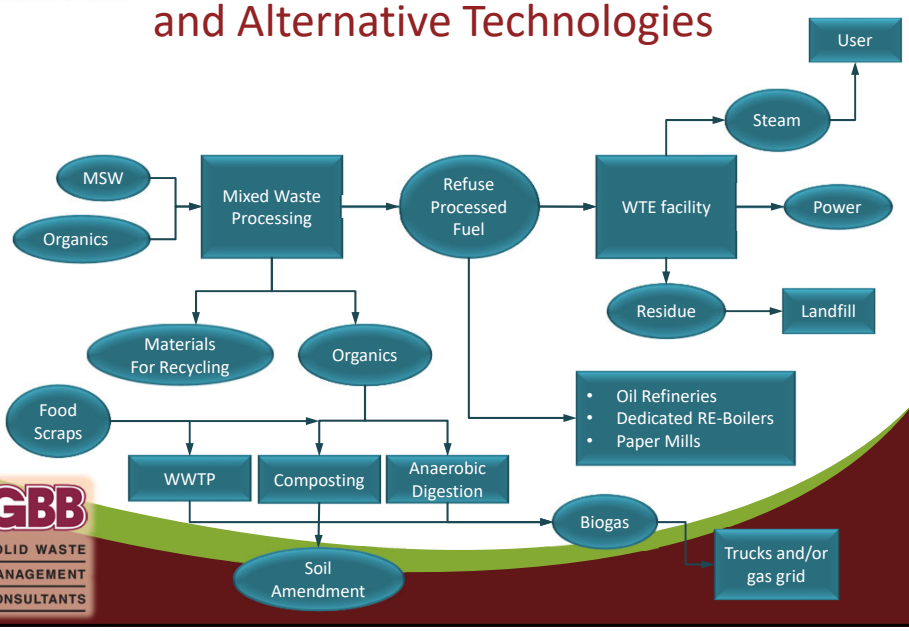
Example of MSW through Processing and Alternative Technologies



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Technologies and Risk

Alternative	Risks/Liability	Risk Summary
Processing for Recyclables and Fuel	Proven commercial technology	Low
Composting	Proven commercial technology	Low
Mass Burn Combustion	Proven commercial technology	Low
RDF Combustion	Proven technology; limited U.S. commercial experience	Moderate to Low
Anaerobic Digestion	Proven technology; limited U.S. commercial experience	Moderate to Low
Mixed-Waste Composting	Previous large failures; limited large-scale plants in operation; product quality issues	Moderate to High
Pyrolysis and Gasification	Previous failures at scale; no operating experience with large -scale operations in the U.S.; full-scale demonstrations nearing operation	High

Source: Gershman, Brickner & Bratton, Inc. 2014

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New Projects in the U.S.


SWAPBC


San José

Quasar


Enerkem


Honolulu


ENEOS Bio

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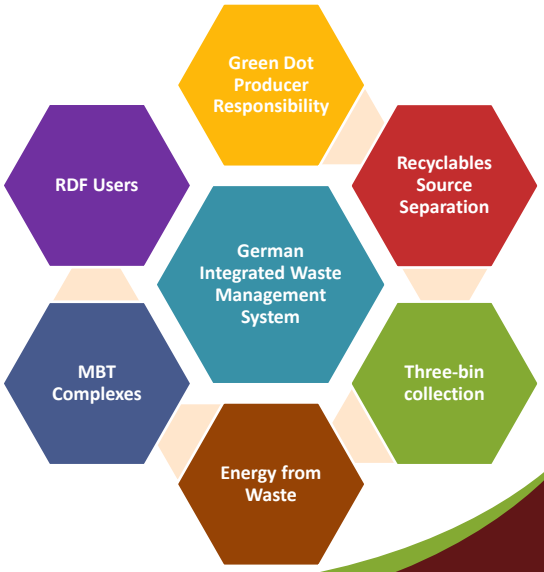
81% of German household goes waste to MBT Plants;
0.4% goes to LF



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Mechanical Biological Treatment

- Originated in Germany in 1999 (now 36 operating MBTs)
- 330 plants in EU most in: Germany, Austria, Italy, Switzerland and the Netherlands; UK catching up
- Includes:
  - Mechanical sorting of recyclables and organics
  - Food scraps and green waste to AD, composting, and mulching
  - Residuals converted to high BTU refuse-derived fuel (RDF)
- RDF key to MBT diversion results
  - 54% to dedicated boilers, 16% to coal plants, 11% to cement kilns and 19% to others

Source: Mechanical Biological Treatment of Municipal Solid Waste. UK Department for Environment Food & Rural Affairs (DEFRA). February 2013

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Waste Management Centre Pohlsche Heide, Germany

MBT with partial flow anaerobic dry digestion

- Publicly owned, privately operated
- The complex has MBT, landfill, WWTP, composting and tunnel anaerobic dry digestion plant for organic waste, and convenience center
  - mixed waste sorting for materials and RDF (double grind)
  - biogas with CHP and biogas to gas grid
  - composting for soil amendment and fertilizer products
  - residue to landfill

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Minden, Germany

Small Sized Industrial RDF With Combined Heat and Power Plant

- Facility takes 35,000 tons of RDF per year from MBT
- BASF, chemical company, next door, uses for process steam
- RDF pays to be combusted as a fuel
  - 35 - 65 Euro per ton

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Hannover, Germany
Energy from Waste Facility

…where the rest of the waste goes!!

http://www.eew-energyfromwaste.com/en/unsere-standorte/hanover.html

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Maryland and the Draft Zero Waste Plan

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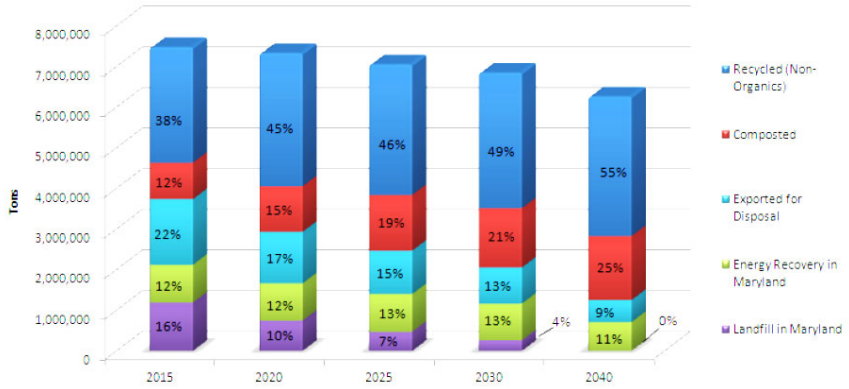
The Draft MD Zero Waste Plan



Source: MD Draft Zero Waste Plan, April 30, 2014

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Draft MD Zero Waste Plan and Alternative Technologies

Objective 6 – 2014-2020

6.2 Encourage anaerobic digestion

6.3 Support gasification and other clean energy technologies

6.4 Utilize waste-to-energy (WTE) for managing solid waste, after maximum removal of recyclables

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Source: MD Draft Zero Waste Plan, April 30, 2014

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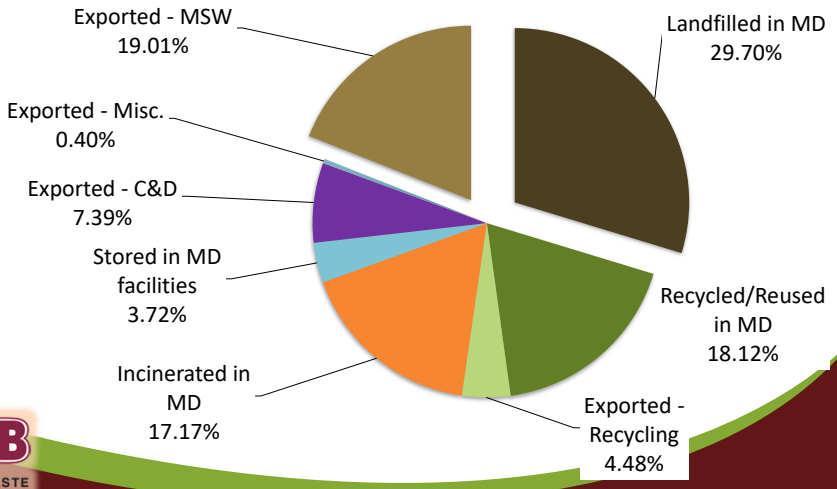
Maryland Solid Waste Management Practices – 8,141,492 Tons (2012)



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Source: Tables 14 and 15 of the 2013 MD SW Management & Diversion Report. Percentages shown do not reflect MRA counting or rates.

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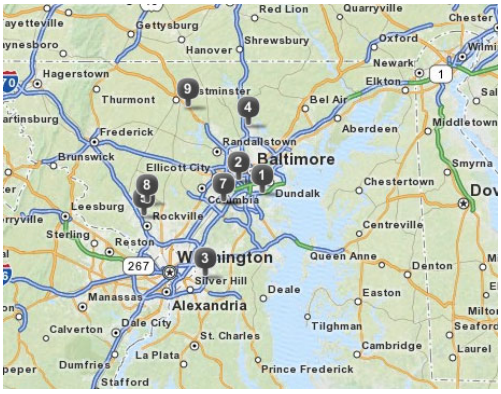
MRFs in Maryland

1.BFI Baltimore
2.Weyerhaeuser Recycling Services
3.Prince George's County Recycling
4.Baltimore Co. Resource Recovery Facility
5.Montgomery Co. Recycling Center
6.Recycle America Commercial Waste
7.Recycle America Single Stream Facility
8.Office Paper Systems, Inc. Fiber MRF
9.Carroll County-Northern Landfill Processing Facility



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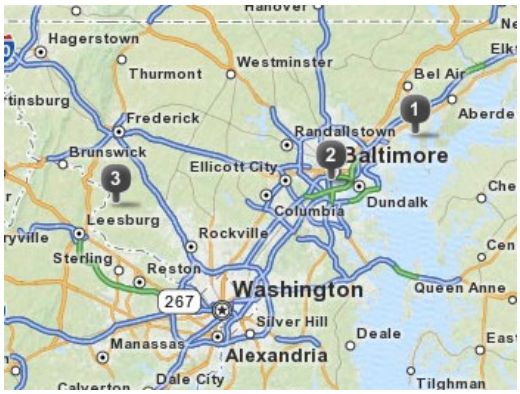
Waste-to-Energy Facilities in Maryland

1.Harford Waste-to-Energy Facility, Joppa
2.Baltimore Refuse Energy Systems Company (BRESCO), Baltimore, MD
3.Montgomery County Resource Recovery Facility, Dickerson, MD



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Publicly-Owned MSW Landfills in MD

- 22 locations with 54.8 million tons remaining capacity
- Largest ones locations & capacity (tons):
  - Washington County – 8 million
  - City of Baltimore – 6 million
  - Anne Arundel County – 5.4 million
  - Baltimore County – 5.1 million
  - Midshore II Regional – 4.4 million
  - Howard County – 4 million
  - Prince George's County – 3.6 million

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Source: 2013 MD SW Management & Diversion Report

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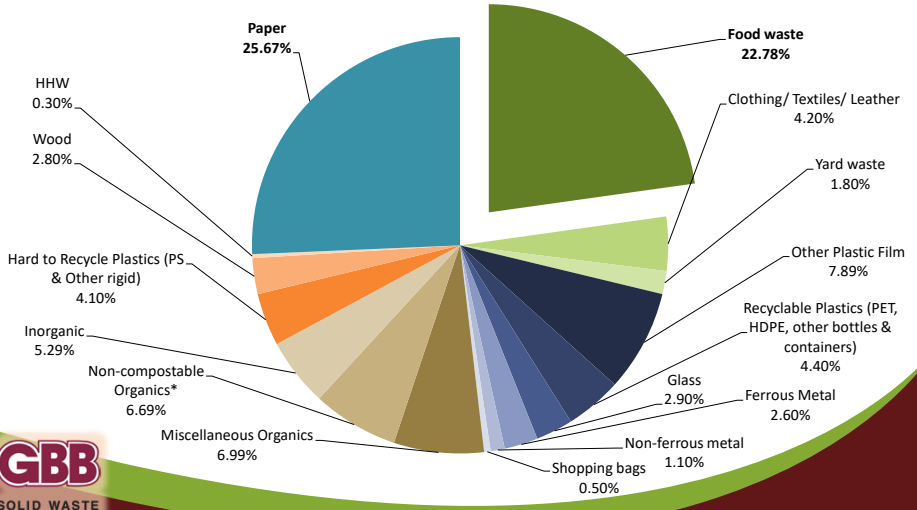
Montgomery County, MD Waste Disposed Composite Composition – 2012/13



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Source: SCS Engineers Report, July 26, 2013

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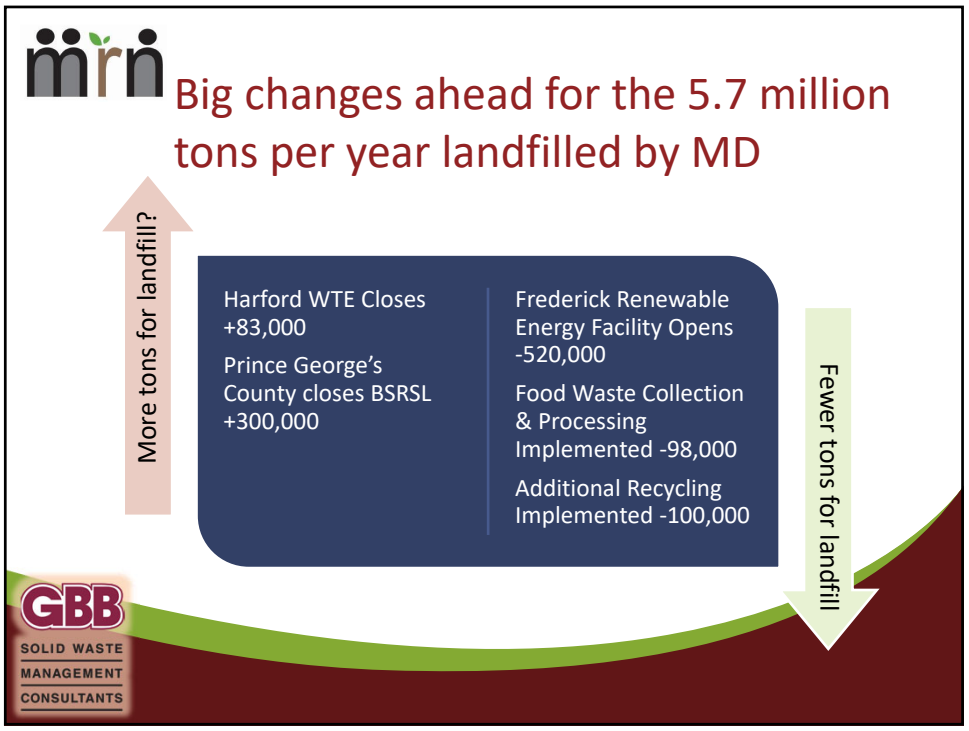
Big changes ahead for the 5.7 million tons per year landfilled by MD
More tons for landfill?
Harford WTE Closes +83,000
Prince George's County closes BSRSL +300,000
Frederick Renewable Energy Facility Opens -520,000
Food Waste Collection & Processing Implemented -98,000
Additional Recycling Implemented -100,000
Fewer tons for landfill
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Organics – What's Coming to Maryland?
Commercial Food Waste Collection Services
Transfer to Peninsula in DE for Processing
Howard County Residential Organics Pilot Collection
Proposed NMWDA Regional Organics Facility
Prince George's County Organics Composting Pilot
Proposed - Peninsula Composting Project
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WTE/CT – What May Come to Maryland?

- Energy Answers – Baltimore
  - 4,000 TPD of Processed Refuse Fuel for 160 MW combined heat and power and 1,150 TPD recyclables and aggregates
  - *Still going forward?*
- Frederick Regional Renewable WTE Facility (through NMWDA)
  - 1,500 TPD Mass Burn for 45 MW power
  - Wheelabrator contracted; permits obtained
  - MSW and biosolids from Frederick, County; looking for another party to take Carroll County's place
- Prince George's County procurement
- Wicomico County procurement

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Challenges in using AT to advance ZWLF

- They are expensive to build
- Some require collection system changes
- There are already a lot of new facilities in the works
- Commercial waste collection not controlled
- Landfilling will cost less without intervention
- Alternative technologies need reliable and predictable streams of waste
  - Can't be an "add-on" or wait for "leftovers"

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Maryland Needs a Green Gate

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China's Green Fence

- Enforcing contaminant levels in recyclables
- Could lead to increased exporting costs
- U.S. will need to find other outlets for recyclables sent to China
- Requires increased processing, resulting in higher costs and lower revenues
  - If we have to make more expensive commodities, why not utilize them domestically?
  - U.S. needs to create market pull for recyclables to be converted domestically

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Maryland Can Become a "Green Gate"

Create circular economies to convert Mid-Atlantic recyclables for manufacturing feedstocks or consumer products

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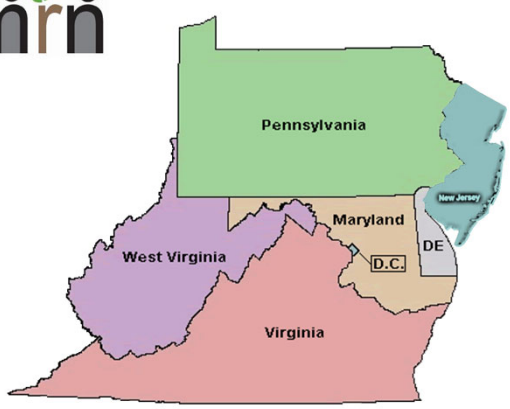

State	Tons Recycled
MD	1,572,200
PA	4,465,949
DE	125,919
NJ	4,346,256
DC	20,122
WV	345,271
VA	2,830,702
Regional Total	13,706,419

Tons Recycled in U.S. EPA Region 3 (plus New Jersey)

Source: GBB

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Moving Forward
in Maryland
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General Trends in the U.S.
Public and financial support for better waste management
More mixed waste processing
"One-for-all," "Wet/Dry," and other novel approaches
Continued discussion among environmentalists regarding WTE and Conversion Technologies
Recognition of waste as a resource
Waste reduction and product stewardship efforts
Reduced environmental impact of products
Increasingly widespread recycling goals
Increased interest in Zero Waste and food recycling
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Recommended Maryland Policies
Ban organics from LF
Promote EPR & re-design
Tax tons disposed
Advance ZWLF
"Green Gate" policies
Streamline permitting
Redirect funds to new programs
Adopt aggressive goals
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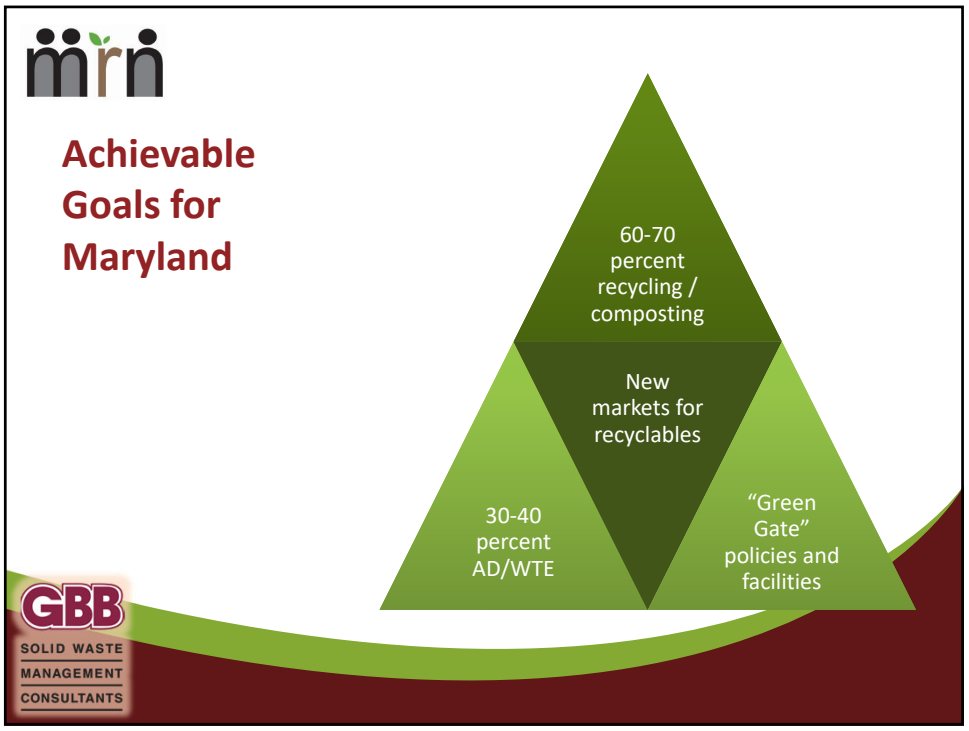
Achievable Goals for Maryland
60-70 percent recycling / composting
New markets for recyclables
30-40 percent AD/WTE
"Green Gate" policies and facilities
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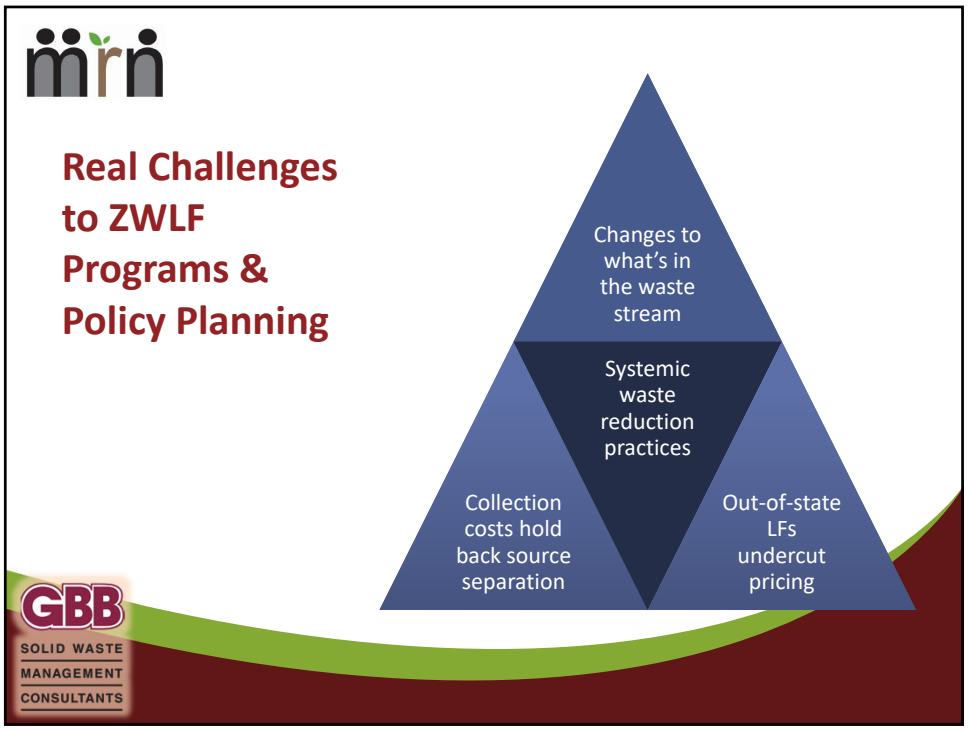
Real Challenges to ZWLF Programs & Policy Planning
Changes to what's in the waste stream
Systemic waste reduction practices
Collection costs hold back source separation
Out-of-state LFs undercut pricing
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Thank you!!
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